



Veneklasen Associates
Consultants in Acoustics & Audio-Visual Design

December 20, 2005
Revised: May 30, 2006

KB HOME SOUTH BAY
6700 Koll Center Parkway, Suite 200
Pleasanton, CA 94566

Attention: Mr. James Lindsay

Subject: **Aster Property**
Sunnyvale, California
Exterior Envelope Acoustical Design
VA Project #2367-025

Dear James:

Veneklasen Associates (VA) has completed our review of the Aster Development Site. This report represents the results of our findings.

1.0 INTRODUCTION

This study was conducted to determine the impact of the exterior noise sources on the multi-family residences, and to recommend the glazing required to reduce interior noise levels to equal to or below acceptable limits based upon the City of Sunnyvale Noise Element, State Building Code and VA's criteria. Exterior noise levels at selected locations were predicted and measured at the site. Based on these levels, interior noise levels were calculated. Several different types of glazing were evaluated and the results are presented in this report.

The project consists of a 3.6 acre parcel which will be developed to include 80 condominium units. The site is located south of Aster Avenue and west of Willow Avenue. The project site is bordered to the south by residential and commercial properties. To the east across Willow Avenue is the Lawrence Expressway, which is elevated as it passes the project. To the north across Aster Avenue is an industrial site operated by Calstone and Peninsula Building Supply, used for rock-crushing/manufacturing operations, warehousing/storage, and related transportation of raw materials and products.

Section 2 of this report describes the criteria that will be used as a basis for design recommendations. Section 3 defines the exterior noise environment of the project site based on measurements and computer modeling. Section 4 evaluates noise levels at private and common exterior use areas, and recommends mitigation measures where necessary to meet the criteria. Section 5 predicts interior noise levels based on various exterior façade constructions, and recommends mitigation, including acoustical ratings of windows, to achieve the criteria.

2.0 NOISE CRITERIA

Ldn is the 24-hour equivalent sound pressure level in which the nighttime noise levels, occurring between the hours of 10pm and 7am, are penalized or weighted by adding 10 dB. The Noise Element of the City of Sunnyvale General Plan states that interior Ldn values for residential land uses are not to exceed 45 Ldn. Exterior Ldn values at outdoor activity areas are compatible up to 60 Ldn.

The above criteria also satisfies the requirements of the California State Building Code (Part 2, Title 24, CCR, Appendix 12, "Sound Transmission Control").

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VA additionally recommends that the maximum noise level from short-duration single noise events do not exceed 55 dBA. VA's maximum criterion is based on sleep disturbance research and our experience with similar projects. Note that this is a recommended criterion that is not required by the Noise Element or any regulatory agency.

3.0 EXTERIOR NOISE MEASUREMENTS

3.1 Noise Measurements

VA visited the site to perform noise measurements of the existing conditions. The dominant noise source impacting the site was from traffic, particularly local heavy truck traffic on Aster Avenue and Willow Avenue associated with operations at Calstone. VA observed a large number of trucks entering and exiting the Calstone facility driveway opposite the western end of the project, and passing adjacent to the project on Aster and Willow Avenues. According to Calstone's operations log, the facility was in full 24-hour operation during the measurement period.

VA positioned two long term noise monitors on the existing project site that operated from Wednesday, November 30, 2005, to Thursday, December 1, 2005. The locations are shown in Figure 1. Both locations were exposed to trucks as they passed by the site, with Location 2 located at the most impacted location across from the Calstone driveway. The long-term monitors recorded both hourly average (L_{eq}) levels as well as hourly maximum levels and spectra.

During the site visit, VA also performed measurements of individual heavy truck pass-bys to obtain noise spectra for accurate calculations. Noise from machinery or other sources on the Calstone site itself was not significant compared to the truck activity.

Table 1 shows the results of the long-term noise monitoring. In addition to the Ldn, both average and maximum noise levels are reported, broken out into daytime (7 am – 10 pm) and nighttime (10 pm – 7 am) levels.

Table 1 – Long Term Noise Monitoring Results

Location	Description	Average Noise Level, Leq dBA		LDN	Average Hourly Maximum Noise Level, dBA	
		Daytime	Nighttime		Daytime	Nighttime
1	Corner of Aster and Willow	62	56	64	82	76
2	Along Aster Ave	64	60	67	87	84

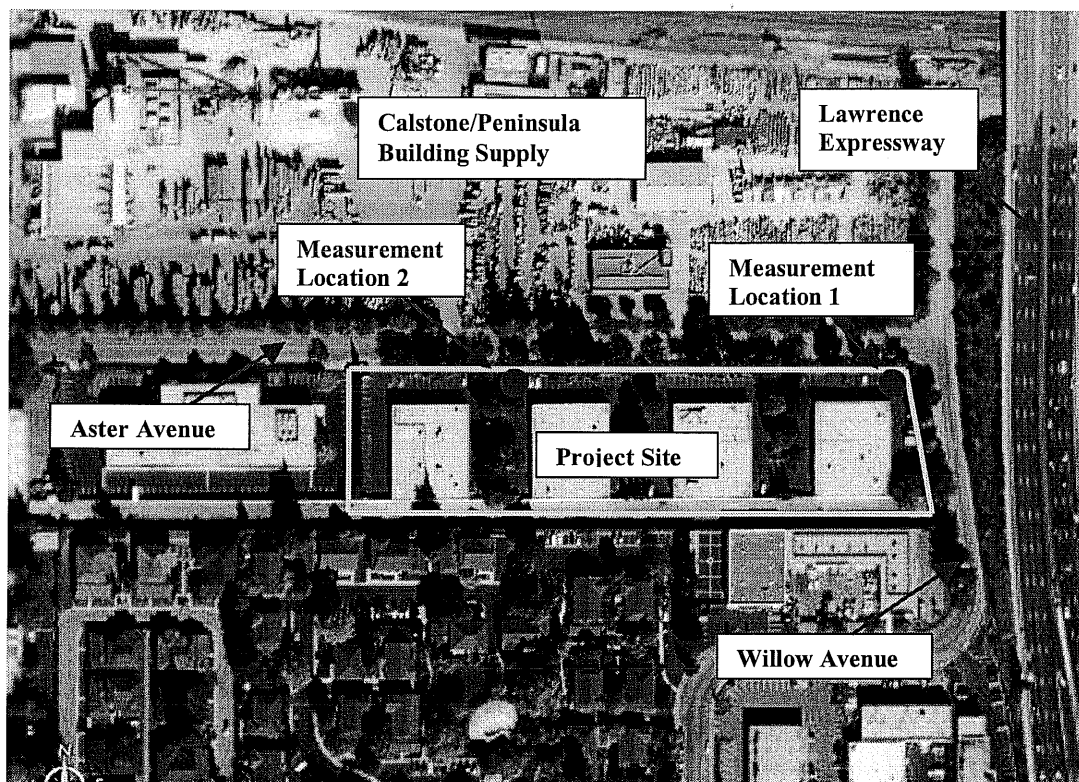


Figure 1 –Noise Monitor Locations

3.2 Computer Modeling—Expressway Noise

The Lawrence Expressway is adjacent to the site, and is elevated as it passes the site. Measurements at location 1 were made at a height of 5 feet. Due to site constraints it was not possible to obtain noise measurements at the height of the proposed second floor. The second story of the homes facing Willow Avenue will have a greater exposure to the roadway than the measured values on the ground.

To estimate the second floor noise levels, VA utilized the Traffic Noise Model computer software program developed by the FHWA (Federal Highway Administration). VA obtained average daily traffic counts (ADT's) for existing conditions from the Google Earth traffic database and has estimated the future (2025) conditions for the Lawrence Expressway using a 1% increase per year.

The computer model indicated that the noise level at the second story would be approximately L_{dn} 70, or 6 dB higher than the measured level at ground level. This is a conservative result consistent with our measurements. The model further indicated that increase in noise level due to increased traffic volume by 2025 is 1dB.

The expected maximum noise levels from traffic on the Expressway are equal or less than the maximum levels from heavy truck pass-bys on Willow. The height of the exhaust pipe of a large tractor-trailer is high enough that it will impact the first and second floors similarly. Therefore, the maximum noise events at the homes facing Willow is expected to be the same at first and second floors.



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3.3 Overall Exterior Exposure

Based on our measurements, the computer model, and the project site plan provided by the Client, VA calculated the existing and future Ldn and maximum noise levels at various locations within the project site. To simplify the analysis and presentation of our results, VA has separated the site into zones based on the sound exposure and required mitigation. The noise exposure zones are shown in Figure 2 below.

The predicted noise levels at each zone are listed in Table 2, below.

Table 2 –Existing, Future, and Maximum Exterior Noise Levels by Zone

Location	Floor	Existing, Ldn	Year 2025, Ldn	Maximum, dBA
Zone A	1	64	65	86
	2	70	71	86
Zone B	1-2	67	68	87
Zone C	1-2	59	60	75

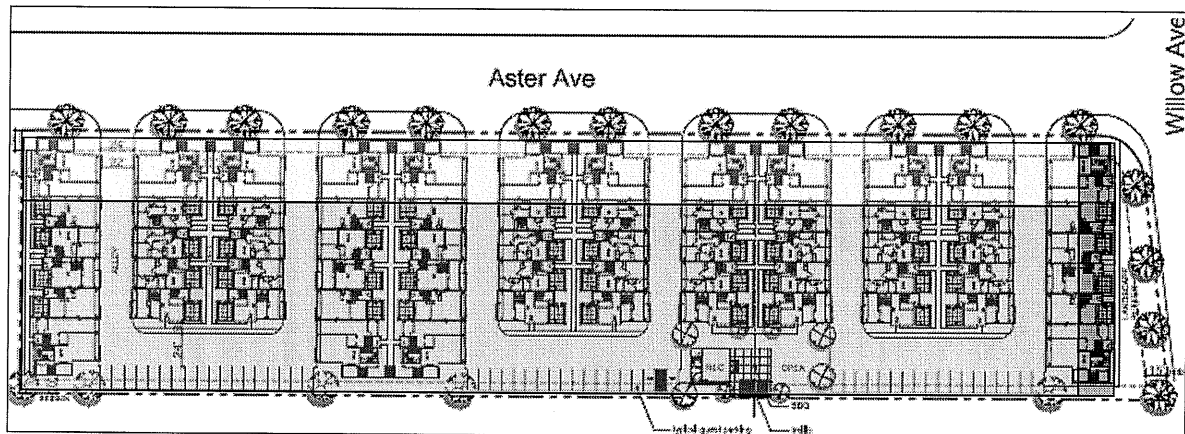


Figure 2 –Noise Exposure Zones

Zone A Zone B Zone C

4.0 EXTERIOR NOISE CALCULATION

The project contains private balcony and patio areas for the condominium units. Our understanding is that only the first floor patios, not the balconies, are included in the open space calculation. Common outdoor usable space includes pedestrian paseos between the buildings, along the eastern property line, and areas on the southern property line.

The noise levels at these spaces are shown in the following table.

**Table 3 – Predicted Future Noise Levels at Outdoor Locations, Ldn**

Zone	Location	Noise Level
Zone A	Patios (1st floor)	65
	Common space on eastern property line	65
	Balconies (2 nd floor)	71
Zone B	Patios (1 st floor flats)	60
	Remaining locations	68
Zone C	All outdoor locations	≤ 60

5.0 INTERIOR NOISE CALCULATION**5.1 Exterior Construction Assumptions**

VA assumed a 2x4 wood stud construction with an exterior wall finish of stucco on ½" plywood and a single layer of gypsum board on the interior, with batt insulation in the cavity. VA's calculations include the wall but indicate that the interior noise levels are controlled by the acoustical performance of the glazing.

For our calculations, VA utilized windows and glass doors shown in Table 4 below. The calculations are based on the typical performance of assemblies with the STC ratings and constructions shown.

Table 4 – Glazing Descriptions

STC Rating	Thickness	Construction
STC 30	1" dual	1/8" lite, 3/4" airspace, 1/8" lite
STC 40	3 ½" Storm (Triple)	1/8" lite, 1/2" airspace, 1/8" lite, 2 9/16" airspace, 1/8" Storm

VA calculated the interior level within the residential units given the measured noise environment and the exterior façade construction described above. The calculations were based on the floor plans for similar projects. The results for each zone are presented in the following tables. (Zones are shown in Figure 2.)

5.2 Interior Average Noise Level (Ldn)

Table 5 shows the predicted interior Ldn noise levels for each zone.

Table 5 – Calculated Future Interior and Exterior Ldn Noise Levels and Their Acceptability

Location	Floor	Exterior Noise Level, Ldn	Glazing	Interior Noise Level, Ldn	Interior Noise Level Criteria, Ldn	Conclusion
Zone A	1	65	STC 30	39	≤ 45	Acceptable
	2	71	STC 30	44		
Zone B	1-2	68	STC 30	41	≤ 45	Acceptable
Zone C	1-2	60	STC 30	36	≤ 45	Acceptable



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5.3 Interior Maximum Noise Level

In a similar manner, VA calculated the maximum interior noise levels. The results are shown in table 6 below.

Table 6 – Calculated Interior and Exterior Maximum Noise Levels and Their Acceptability

Location	Exterior Maximum Noise Level, dBA	Glazing	Interior Noise Level, dBA	Recommended Interior Maximum, dBA	Conclusion
Zone A	86	STC 40	55	≤ 55	Acceptable
Zone B	87	STC 40	55	≤ 55	Acceptable
Zone C	75	STC 30	52	≤ 55	Acceptable

5.4 Mechanical Ventilation Requirement

Because the windows and doors must be kept closed to meet the noise requirements, mechanical ventilation is required in all residential units. The mechanical ventilation shall meet all Code requirements, including the capability to provide sufficient fresh air exchanges, without depending on open windows or leakage through windows and doors. The ventilation system shall not compromise the sound insulation capability of the exterior façade assembly.

6.0 CONCLUSION

In order to satisfy the noise criteria, as described in section two, Table 7 presents our suggested glazing requirements.

Table 7 – VA's Mitigation Method

Location	Glazing
Zone A	STC 40
Zone B	STC 40
Zone C	STC 30

We trust this information is satisfactory. If you have any questions or comments regarding this report, please do not hesitate to contact us.

Sincerely,
Veneklasen Associates, Inc.

John Gorr
Associate

Wayland Dong
Associate